PATENT ABSTRACTS OF JAPAN

(11)Publication number : 08-163857
(43)Date of publication of application : 21.06.1996

(51)Int.Cl. H02K 41/03

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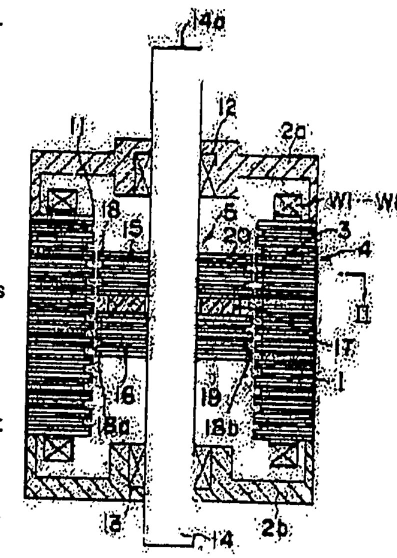
(54) ROTARY LINEAR PULSE MOTOR

(57)Abstract:
PURPOSE: To obtain a rotary linear pulse motor performing both linear motion and rotary motion by providing a mover having a pair of mover cores each provided with a plurality of small teeth in the circumferential direction of the mover, and a permanent magnet interposed between the mover cores while being magnetized in the axial direction.



CONSTITUTION: A motor housing 4 has a bracket 2a on the output shaft side and a bracket 2b on the opposite side which are provided, respectively, with bearings 12, 13 for bearing a mover 5 movably in the axial direction and rotatably in the circumferential direction. The mover 5 comprises a shaft 14, pole cores 15, 16, and a permanent ring magnet 17 held between the pole cores 15, 16 while being in the axial direction. Respective phase windings are excited

sequentially depending on the input pulse to induce flux sequentially between each small tooth 11 in the axial direction of the stator and the small tooth 18 in the axial direction of the mover thus stepping the mover 5 in the axial direction while rotating in the circumferential direction.

LEGAL STATUS

[Date of request for examination]	30.10.2001
[Date of sending the examiner's decision of rejection]	03.12.2002
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]	
[Date of final disposal for application]	
[Patent number]	
[Date of registration]	
[Number of appeal against examiner's decision of rejection]	
[Date of requesting appeal against examiner's decision of rejection]	
[Date of extinction of right]	

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CLAIMS

[Claim(s)]
[Claim 1] Along with a circumferencial direction, at intervals of predetermined, while establishing two or more salient poles in inner skin, in accordance with shaft orientations, two or more stator shaft-orientations paragnaths are formed at the tip of this salient pole at it. It can rotate freely on the cylinder-like stator which has the stator core which formed the stator circumferencial direction paragnath at the tip of these stators shaft-orientations paragnath at the circumferencial direction, and the axis of this stator. Two or more migration child shaft-orientations paragnaths in a pitch are formed. and -- while being arranged movable in accordance with shaft orientations -- the shaft orientations of a peripheral face -- the above-mentioned stator shaft-orientations paragnath -- countering -- etc. -- And the rotation form linear pulse motor characterized by having the permanent magnet which intervened between [above-mentioned] migration child cores with the migration child who has the migration child core of the pair which formed two or more migration child circumferencial direction paragnaths in the point of these migration child shaft-orientations paragnath along with the circumferencial direction, and was magnetized by shaft orientations.
[Claim 2] while the above-mentioned stator core carries out the laminating of the stator griddle and being formed -- each stator griddle -- a circumferencial direction -- meeting -- every [a predetermined include angle], when the configuration of the point of the salient pole which counters with the above-mentioned migration child sees from a migration child side, while carrying out a laminating, being able to shift one by one The rotation form linear pulse motor according to claim 1 characterized by for the salient pole where a bore is small, and the salient pole where a bore is large forming 1 set together with predetermined order, and k sets of the group existing.

[Claim 3] the rotation form linear pulse motor according to claim 1 or 2 characterized by having carried out the laminating of the migration child griddle which the above-mentioned migration child kept predetermined spacing in the peripheral face, and formed two or more migration child circumferencial direction paragnaths, and the migration child griddle which does not form the migration child circumferencial direction paragnath alternately with predetermined number of sheets every, and forming it.
[Claim 4] For the above-mentioned migration child's migration child circumferencial direction paragnath, a number of teeth is [50 pieces or those of 50 with an integral multiple, and the stator circumferencial direction paragnath of a stator] claim 1 to which it is characterized by being formed in the pitch into which the periphery was divided by the number of the integral multiples of 48 or 50 thru/or a rotation form linear pulse motor given in 3.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the rotation form linear pulse motor which can perform a straight-line motion and rotation actuation by one motor.
[0002]
[Description of the Prior Art] Drawing 7 is what showed the conventional rotation form linear pulse motor known well, and consists of a stator 100 and a migration child 101. A stator 100 arranges the stator cores 103,104,105 and 106 in a frame 102, and the ring-like coil 108,109 is arranged in the concave 107 formed between stator core 103,104 and between stator core 105,106. The stator core 103,104 forms one phase with the ring-like coil 108, and the stator core 105,106 forms other one phase with the ring-like coil 109.
[0003] Two or more stator paragnaths 110 in pitches [shaft orientations] are formed in the inner skin of the stator cores 103,104,105 and 106. The stator core 103,104 which forms two phases, and the stator core 105,106 arrange the ring-like permanent magnet 111 magnetized by shaft orientations in the meantime, and constitute the stator 100 of two phases as a whole.
[0004] The migration child 101 consists of a migration child core 112 and a shaft 113, and two or more migration child paragnaths 114 are formed in the peripheral face of this migration child core 112 in pitches [shaft orientations] with the same pitch as the gear-tooth pitch of the stator paragnath 110.
[0005] This migration child 101 is supported through bearing 117,118 by the bracket 115,116 prepared in frame 102 both ends.
[0006] Said stator paragnath 110 and the migration child paragnath 114 are in the following physical relationship. that is, when the stator paragnath 110

arranged by the stator core 106 has faced the migration child paragnath 114 exactly, the stator paragnath 110 arranged by the stator core 105 is in the location which shifted to shaft orientations only two fourths of gear-tooth pitches to the migration child paragnath 114 (or the stator core 106 -- comparing), and has countered the bottom section of the migration child paragnath 114. Moreover, the stator paragnath 110 arranged by the stator core 104 is in the location which shifted to shaft orientations only one fourth of gear-tooth pitches similarly. Furthermore, the stator paragnath 110 arranged by the stator core 103 is in the location which shifted to shaft orientations only three fourths of gear-tooth pitches similarly.
[0007] And according to an input pulse, by energizing in predetermined sequence to said ring-like coils 108 and 109, generate magnetic flux one by one between each stator paragnath 110 and the migration child paragnath 114, the shape of a step is made to carry out stepping actuation of the migration child 101, and, as for said rotation form linear pulse motor, basic movement magnitude constitutes one fourth of 2 phase hybrid mold linear pulse motors of the gear-tooth pitch of the migration child paragnath 114.
[0008] The technique of JP,63-31462,A is known as a conventional technique to which Rota of a stepping motor is made to carry out rectilinear motion on the other hand, rotating. In this advanced technology, as shown in drawing 8 , the spiral slot 202 is formed in the peripheral face of Rota 201, and the magnet 204,205 of N pole and the south pole is magnetized by turns to the spiral heights 203 between slots. And shaft orientations are made to carry out a step drive at fixed spacing, arranging the salient pole 207 of a stator 206 established in the circumferencial direction at fixed spacing at fixed spacing to shaft orientations, carrying out sequential excitation of the salient pole 207 of this stator 206, and making a circumferencial direction carry out the step drive of Rota 201 at fixed spacing.
[0009]
[Problem(s) to be Solved by the Invention] However, since the spiral slot 202 is formed in the peripheral face of Rota 201 and the spiral heights 203 between slots were made to magnetize many magnets 204,205 in the aforementioned advanced technology, while the production process was complicated, dispersion in precision was large and it was comparatively high-priced also in respect of cost.
[0010] While this invention can cancel the above-mentioned technical problem and one motor can perform a straight-line motion and rotation actuation, it aims at offering the rotation form linear pulse motor which can be manufactured with high precision and cheaply.
[0011]
[Means for Solving the Problem] In order that this invention may solve the

more salient poles along with a circumferencial direction in inner skin. It can rotate freely on the cylinder-like stator which has the stator core which formed the stator circumferencial direction paragnath at the tip of these stators shaft-orientations paragnath at the circumferencial direction, and the axis of this stator. Two or more migration child shaft-orientations paragnaths in a pitch are formed. and -- while being arranged movable in accordance with shaft orientations -- the shaft orientations of a peripheral face -- the above-mentioned stator shaft-orientations paragnath -- countering -- etc. -- And since it had the permanent magnet which intervened between [above-mentioned] migration child cores with the migration child who has the migration child core of the pair which formed two or more migration child circumferencial direction paragnaths in the point of these migration child shaft-orientations paragnath along with the circumferencial direction, and was magnetized by shaft orientations By exciting a stator core, a migration child core carries out a step drive at a circumferencial direction while carrying out a step drive at shaft orientations, while a straight-line motion and rotation actuation can carry out by one motor, compared with the conventional motor, it is cheap, and precision improves. Since the laminating of the annular solid in which the migration child circumferencial direction paragnath was formed, and the annular solid which does not form a migration child circumferencial direction paragnath was carried out to the peripheral face and the migration child core was formed while carrying out the laminating and forming the stator core, being able to shift a stator griddle one by one to a circumferencial direction, shaping of a stator core and a migration child core can form an easy and highly precise rotation form linear pulse motor.

[0013]

[Example] Hereafter, one example of this invention is explained to a detail, referring to a drawing. Partial drawing of longitudinal section in which drawing 1 shows one example of the rotation form linear pulse motor of this invention, The cross-sectional view according [drawing 2] to the II-II line of drawing 1 , the top view of a stator griddle in which drawing 3 forms a stator core, The top view showing the migration child griddle in which drawing 4 prepared the migration child circumferencial direction paragnath, the top view showing the migration child griddle in which drawing 5 does not prepare a migration child circumferencial direction paragnath, and drawing 6 are the development views which looked at the stator shaft-orientations paragnath section when carrying out the laminating of the stator griddle of drawing 3 from the migration child side.

[0014] In drawing 1 thru/or drawing 6 , a stator 1 is supported by carrying out a screw stop to output side shaft bracket 2a with the screw which is

above-mentioned technical problem, along with a circumferencial direction, it is predetermined spacing at inner skin. The cylinder-like stator which has the stator core which formed two or more stator shaft-orientations paragnaths at the tip of this salient pole in accordance with shaft orientations while preparing two or more salient poles, and formed the stator circumferencial direction paragnath at the tip of these stators shaft-orientations paragnath at the circumferencial direction, While being able to rotate freely and being arranged movable in accordance with shaft orientations on the axis of this stator Two or more migration child shaft-orientations paragnaths in a pitch are formed. the shaft orientations of a peripheral face -- the above-mentioned stator shaft-orientations paragnath -- countering -- etc. -- And it is in having had the permanent magnet which intervened between [above-mentioned] migration child cores with the migration child who has the migration child core of the pair which formed two or more migration child circumferencial direction paragnaths in the point of these migration child shaft-orientations paragnath along with the circumferencial direction, and was magnetized by shaft orientations. moreover -- while the above-mentioned stator core carries out the laminating of the stator griddle and this invention is formed -- each stator griddle -- a circumferencial direction -- meeting -- every [a predetermined include angle] -- while carrying out a laminating, being able to shift one by one, when the configuration of the point of the salient pole which counters with the above-mentioned migration child sees from a migration child side, the salient pole where a bore is small, and the salient pole where a bore is large form 1 set together with predetermined order, and it is in k sets of the group existing. furthermore, this invention has the above-mentioned migration child in having carried out the laminating of the migration child griddle which kept predetermined spacing in the peripheral surface and formed two or more migration child circumferencial direction paragnaths, and the migration child griddle which does not form the migration child circumferencial direction paragnath alternately with predetermined number of sheets every, and having formed it. Furthermore, 50 pieces or those of 50 with an integral multiple, and the stator circumferencial direction paragnath of a stator have the above-mentioned migration child's migration child circumferencial direction paragnath in being formed in the pitch into which the number of teeth was divided by the number of the integral multiples of 48 or 50 in the periphery.

[0012]

[Function] This invention forms two or more stator shaft-orientations paragnaths at the tip of this salient pole in accordance with shaft orientations at it while it is predetermined spacing and establishes two or

[0020] Drawing 3 shows an example of the stator griddle 22 which forms the stator core 3. Eight salient poles P1 thru/or the inside P3, P4, P7, and P8 of P8 are salient poles (this example four pieces) where an inside diameter is small, and the stator griddle 22 constitutes addendum section 11a of the stator shaft-orientations paragnath 11. Moreover, P1, P2, P5, and P6 are salient poles where an inside diameter is big, and they constitute bottom section 11b of the stator shaft-orientations paragnath 11 (this example four pieces). Corresponding to the above-mentioned migration child circumferencial direction paragnath 21, the stator circumferencial direction paragnath 23 is formed in addendum section 11a of the stator shaft-orientations paragnath 11 at intervals of predetermined along with the circumferencial direction, respectively.
[0021] Drawing 6 looks at the situation of the salient pole 61 formed when a laminating is carried out rotating the stator griddle 22 theta= 45 include angles at a time thru/or the stator shaft-orientations paragnath 11 of 68 from the migration child 5 side. A part with hatching shows addendum section 11a, and a part without hatching shows bottom section 11b.
[0022] It is the thickness of the stator griddle 22 t0 When it carries out, for a gear-tooth pitch, in each salient pole 61 thru/or 68, 2kmt(s)0, 4 [i.e.,], t0 (k= 1, m= 2), and tooth thickness are m-t0, 2 [i.e.,], and t0 by carrying out a rotation laminating. The stator shaft-orientations paragnath 11 is formed. and the time of being based on salient poles 61 and 65 -- a gap of the paragnath 11 of salient poles 62 and 66 -- a gap of the paragnath 11 of salient poles, 1/2km, 1/4 [i.e.,], of a gear-tooth pitch, 63 and 67 -- a gap of the paragnath 11 of salient poles, 2/2km, 2/4 [i.e.,], of a gear-tooth pitch, 64 and 68 -- 3/2km of a gear-tooth pitch -- that is, it comes out 3/4.
[0023] On the other hand, the paragnath 18 in which the die length of the shaft orientations of the permanent magnet 17 arranged by said migration child 5 was arranged by said magnetic pole core 15, and the paragnath 18 arranged by the magnetic pole core 16 are set up so that a gear-tooth pitch may shift 1/2 mutually.
[0024] And the hybrid mold linear pulse motor of two phases can be constituted by connecting the phase by which a coil W1, W3, and the phase around which W5 and W7 are wound are wound around an A phase and coils W2, W4, W6, and W8 so that it may become a B phase. The basic movement magnitude for every step at this time becomes 1/of a gear-tooth pitch (2andm), /4 [i.e., (4 and t0),], and is the thickness t0 of said stator griddle 22. It becomes.
[0025] And according to an input pulse, by carrying out sequential excitation of each phase winding in predetermined sequence, while generating magnetic

not illustrated with anti-output-shaft side bracket 2b. This stator 1 consists of a stator winding W1 wound around each salient pole 61 of the stator core 3 and the stator core 3 thru/or 68 thru/or W8. The above-mentioned output side shaft bracket 2a and anti-output-shaft side bracket 2b constitute the motor housing 4 with the external surface of a stator 1. The migration child 5 who mentions later is supported by output side shaft bracket 2a and anti-output-shaft side bracket 2b.
[0015] The above-mentioned stator core 3 is what prepared the salient pole 61 projected towards the direction of a core to inner skin thru/or 68 at intervals of predetermined along with the circumferencial direction, and is prepared in these salient poles 61 thru/or 68 inner skin in pitches [paragnaths / 11 / two or more / stator shaft-orientations] at shaft orientations.
[0016] A stator winding W1 thru/or W8 are wound around these eight salient poles 61 thru/or 68 at each **, respectively.
[0017] In output-shaft side bracket 2a of the above-mentioned motor housing 4, and anti-output-shaft side bracket 2b, bearing 12 and 13 is formed, respectively, and, free [migration] moreover, the above-mentioned migration child 5 is supported free [rotation] through these bearing 12 and 13 at the circumferencial direction at shaft orientations. This migration child 5 consists of permanent magnets 17 of the shape of a ring which was pinched a shaft 14, the magnetic pole cores 15 and 16 prepared in this shaft 14, the magnetic pole core 15, and between 16, and was magnetized by shaft orientations. The rolling bearing which moreover supports a shaft 14 movable to shaft orientations at a circumferencial direction is being used for the above-mentioned bearing 12 and 13.
[0018] Two or more migration child shaft-orientations paragnaths 18 (addendum section 18a, bottom section 18b) are arranged in shaft orientations by the peripheral face of the above-mentioned magnetic pole cores 15 and 16. These magnetic pole cores 15 and 16 As shown in drawing 3 and drawing 4 , the laminating of the small migration child griddle (annular solid) 20 of an outer diameter in which the large migration child griddle (annular solid) 19 of the outer diameter which forms addendum section 18a forms two sheets and bottom section 18b is carried out in the order of two sheets. The migration child circumferencial direction paragnath 21 is formed in the peripheral face of the migration child griddle 19 at intervals of predetermined.
[0019] End section 14a which takes out an output is drawn by the outside of output-shaft side bracket 2a, and other end 14b which does not take out an output is drawn from the above-mentioned migration child's 5 shaft 14 by the outside of anti-output-shaft side bracket 2b.

/o

predetermined spacing in the peripheral face and formed two or more migration child circumferencial direction paragnaths, and the migration child griddle which does not form the migration child circumferencial direction paragnath alternately with predetermined number of sheets every and formed it, he can fabricate the high migration child core of precision easily. In claim 4, since 50 pieces or those of 50 with an integral multiple, and the stator circumferencial direction paragnath of a stator are formed in the pitch into which the number of teeth was divided by the number of the integral multiples of 48 or 50 in the periphery, the above-mentioned migration child's migration child circumferencial direction paragnath can perform the step drive with a high precision.

[Translation done.]

flux one by one between each stator shaft-orientations paragnath 11 and the migration child shaft-orientations paragnath 18 and making shaft orientations carry out stepping actuation of the migration child 5 at the shape of a step, a circumferencial direction can be rotated in the shape of a step.

[0026] In addition, the technique of this invention is good also by the means of other modes which are not limited to the technique in said example and achieve the same function, and various modification and addition are possible for the technique of this invention within the limits of said configuration.

[0027]

[Effect of the Invention] According to the rotation form linear pulse motor of this invention, the following effectiveness is done so so that clearly from the above explanation. In claim 1 Along with a circumferencial direction, at intervals of predetermined, while establishing two or more salient poles in inner skin, in accordance with shaft orientations, two or more stator shaft-orientations paragnaths are formed at the tip of this salient pole at it. It can rotate freely on the cylinder-like stator which has the stator core which formed the stator circumferencial direction paragnath at the tip of these stators shaft-orientations paragnath at the circumferencial direction, and the axis of this stator. Two or more migration child shaft-orientations paragnaths in a pitch are formed. and -- while being arranged movable in accordance with shaft orientations -- the shaft orientations of a peripheral face -- the above-mentioned stator shaft-orientations paragnath -- countering -- etc. -- And since it had the permanent magnet which intervened between [above-mentioned] migration child cores with the migration child who has the migration child core of the pair which formed two or more migration child circumferencial direction paragnaths in the point of these migration child shaft-orientations paragnath along with the circumferencial direction, and was magnetized by shaft orientations One motor can perform a straight-line motion and rotation actuation. while the above-mentioned stator core carries out the laminating of the stator griddle and being formed in claim 2 -- each stator griddle -- a circumferencial direction -- meeting -- every [a predetermined include angle] -- with the salient pole where a bore is small, when the configuration of the point of the salient pole which counters with the above-mentioned migration child sees from a migration child side, while carrying out a laminating, being able to shift one by one Since the salient pole where a bore is large forms 1 set together with predetermined order and k sets of the group exists, a stator can be fabricated easily. in claim 3, since the above-mentioned migration child did the laminating of the migration child griddle which kept

PRIOR ART

[Description of the Prior Art] Drawing 7 is what showed the conventional rotation form linear pulse motor known well, and consists of a stator 100 and a migration child 101. A stator 100 arranges the stator cores 103,104,105 and 106 in a frame 102, and the ring-like coil 108,109 is arranged in the concave 107 formed between stator core 103,104 and between stator core 105,106. The stator core 103,104 forms one phase with the ring-like coil 108, and the stator core 105,106 forms other one phase with the ring-like coil 109.
[0003] Two or more stator paragnaths 110 in pitches [shaft orientations] are formed in the inner skin of the stator cores 103,104,105 and 106. The stator core 103,104 which forms two phases, and the stator core 105,106 arrange the ring-like permanent magnet 111 magnetized by shaft orientations in the meantime, and constitute the stator 100 of two phases as a whole.
[0004] The migration child 101 consists of a migration child core 112 and a shaft 113, and two or more migration child paragnaths 114 are formed in the peripheral face of this migration child core 112 in pitches [shaft orientations] with the same pitch as the gear-tooth pitch of the stator paragnath 110.
[0005] This migration child 101 is supported through bearing 117,118 by the bracket 115,116 prepared in frame 102 both ends.
[0006] Said stator paragnath 110 and the migration child paragnath 114 are in the following physical relationship. that is, when the stator paragnath 110 arranged by the stator core 106 has faced the migration child paragnath 114 exactly, the stator paragnath 110 arranged by the stator core 105 is in the location which shifted to shaft orientations only two fourths of gear-tooth pitches to the migration child paragnath 114 (or the stator core 106 -- comparing), and has countered the bottom section of the migration child paragnath 114. Moreover, the stator paragnath 110 arranged by the stator

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TECHNICAL FIELD

[Industrial Application] This invention relates to the rotation form linear pulse motor which can perform a straight-line motion and rotation actuation by one motor.

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention] According to the rotation form linear pulse motor of this invention, the following effectiveness is done so so that clearly from the above explanation. In claim 1 Along with a circumferencial direction, at intervals of predetermined, while establishing two or more salient poles in inner skin, in accordance with shaft orientations, two or more stator shaft-orientations paragnaths are formed at the tip of this salient pole at it. It can rotate freely on the cylinder-like stator which has the stator core which formed the stator circumferencial direction paragnath at the tip of these stators shaft-orientations paragnath at the circumferencial direction, and the axis of this stator. Two or more migration child shaft-orientations paragnaths in a pitch are formed. and -- while being arranged movable in accordance with shaft orientations -- the shaft orientations of a peripheral face -- the above-mentioned stator shaft-orientations paragnath -- countering -- etc. -- And since it had the permanent magnet which intervened between [above-mentioned] migration child cores with the migration child who has the migration child core of the pair which formed two or more migration child circumferencial direction paragnaths in the point of these migration child shaft-orientations paragnath along with the circumferencial direction, and was magnetized by shaft orientations One motor can perform a straight-line motion and rotation actuation. while the above-mentioned stator core carries out the laminating of the stator griddle and being formed in claim 2 -- each stator griddle -- a circumferencial direction -- meeting -- every [a predetermined include angle] -- with the salient pole where a bore is small, when the configuration of the point of the salient pole which counters with the above-mentioned migration child sees from a migration child side, while carrying out a laminating, being able to shift one by one Since the salient pole where a bore is large forms 1 set together with predetermined order and k sets of the group exists, a stator can be fabricated easily. in claim 3, since the above-mentioned migration

core 104 is in the location which shifted to shaft orientations only one fourth of gear-tooth pitches similarly. Furthermore, the stator paragnath 110 arranged by the stator core 103 is in the location which shifted to shaft orientations only three fourths of gear-tooth pitches similarly.
[0007] And according to an input pulse, by energizing in predetermined sequence to said ring-like coils 108 and 109, generate magnetic flux one by one between each stator paragnath 110 and the migration child paragnath 114, the shape of a step is made to carry out stepping actuation of the migration child 101, and, as for said rotation form linear pulse motor, basic movement magnitude constitutes one fourth of 2 phase hybrid mold linear pulse motors of the gear-tooth pitch of the migration child paragnath 114.
[0008] The technique of JP,63-31462,A is known as a conventional technique to which Rota of a stepping motor is made to carry out rectilinear motion on the other hand, rotating. In this advanced technology, as shown in drawing 8 , the spiral slot 202 is formed in the peripheral face of Rota 201, and the magnet 204,205 of N pole and the south pole is magnetized by turns to the spiral heights 203 between slots. And shaft orientations are made to carry out a step drive at fixed spacing, arranging the salient pole 207 of a stator 206 established in the circumferencial direction at fixed spacing at fixed spacing to shaft orientations, carrying out sequential excitation of the salient pole 207 of this stator 206, and making a circumferencial direction carry out the step drive of Rota 201 at fixed spacing.

[Translation done.]

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, since the spiral slot 202 is formed in the peripheral face of Rota 201 and the spiral heights 203 between slots were made to magnetize many magnets 204,205 in the aforementioned advanced technology, while the production process was complicated, dispersion in precision was large and it was comparatively high-priced also in respect of cost.
[0010] While this invention can cancel the above-mentioned technical problem and one motor can perform a straight-line motion and rotation actuation, it aims at offering the rotation form linear pulse motor which can be manufactured with high precision and cheaply.

[Translation done.]

child did the laminating of the migration child griddle which kept predetermined spacing in the peripheral face and formed two or more migration child circumferencial direction paragnaths, and the migration child griddle which does not form the migration child circumferencial direction paragnath alternately with predetermined number of sheets every and formed it, he can fabricate the high migration child core of precision easily.
In claim 4, since 50 pieces or those of 50 with an integral multiple, and the stator circumferencial direction paragnath of a stator are formed in the pitch into which the number of teeth was divided by the number of the integral multiples of 48 or 50 in the periphery, the above-mentioned migration child's migration child circumferencial direction paragnath can perform the step drive with a high precision.

[Translation done.]

surface and formed two or more migration child circumferencial direction paragnaths, and the migration child griddle which does not form the migration child circumferencial direction paragnath alternately with predetermined number of sheets every, and having formed it. Furthermore, 50 pieces or those of 50 with an integral multiple, and the stator circumferencial direction paragnath of a stator have the above-mentioned migration child's migration child circumferencial direction paragnath in being formed in the pitch into which the number of teeth was divided by the number of the integral multiples of 48 or 50 in the periphery.

[Translation done.]

MEANS

[Means for Solving the Problem] In order that this invention may solve the above-mentioned technical problem, along with a circumferencial direction, it is predetermined spacing at inner skin. The cylinder-like stator which has the stator core which formed two or more stator shaft-orientations paragnaths at the tip of this salient pole in accordance with shaft orientations while preparing two or more salient poles, and formed the stator circumferencial direction paragnath at the tip of these stators shaft-orientations paragnath at the circumferencial direction, While being able to rotate freely and being arranged movable in accordance with shaft orientations on the axis of this stator Two or more migration child shaft-orientations paragnaths in a pitch are formed. the shaft orientations of a peripheral face -- the above-mentioned stator shaft-orientations paragnath -- countering -- etc. -- And it is in having had the permanent magnet which intervened between [above-mentioned] migration child cores with the migration child who has the migration child core of the pair which formed two or more migration child circumferencial direction paragnaths in the point of these migration child shaft-orientations paragnat along with the circumferencial direction, and was magnetized by shaft orientations. moreover -- while the above-mentioned stator core carries out the laminating of the stator griddle and this invention is formed -- each stator griddle -- a circumferencial direction -- meeting -- every [a predetermined include angle] -- while carrying out a laminating, being able to shift one by one, when the configuration of the point of the salient pole which counters with the above-mentioned migration child sees from a migration child side, the salient pole where a bore is small, and the salient pole where a bore is large form 1 set together with predetermined order, and it is in k sets of the group existing. furthermore, this invention has the above-mentioned migration child in having carried out the laminating of the migration child griddle which kept predetermined spacing in the peripheral

EXAMPLE

[Example] Hereafter, one example of this invention is explained to a detail, referring to a drawing. Partial drawing of longitudinal section in which drawing 1 shows one example of the rotation form linear pulse motor of this invention, The cross-sectional view according [drawing 2] to the II-II line of drawing 1 , the top view of a stator griddle in which drawing 3 forms a stator core, The top view showing the migration child griddle in which drawing 4 prepared the migration child circumferencial direction paragnath, the top view showing the migration child griddle in which drawing 5 does not prepare a migration child circumferencial direction paragnath, and drawing 6 are the development views which looked at the stator shaft-orientations paragnath section when carrying out the laminating of the stator griddle of drawing 3 from the migration child side.
[0014] In drawing 1 thru/or drawing 6 , a stator 1 is supported by carrying out a screw stop to output side shaft bracket 2a with the screw which is not illustrated with anti-output-shaft side bracket 2b. This stator 1 consists of a stator winding W1 wound around each salient pole 61 of the stator core 3 and the stator core 3 thru/or 68 thru/or W8. The above-mentioned output side shaft bracket 2a and anti-output-shaft side bracket 2b constitute the motor housing 4 with the external surface of a stator 1. The migration child 5 who mentions later is supported by output side shaft bracket 2a and anti-output-shaft side bracket 2b.
[0015] The above-mentioned stator core 3 is what prepared the salient pole 61 projected towards the direction of a core to inner skin thru/or 68 at intervals of predetermined along with the circumferencial direction, and is prepared in these salient poles 61 thru/or 68 inner skin in pitches [paragnaths / 11 / two or more / stator shaft-orientations] at shaft orientations.
[0016] A stator winding W1 thru/or W8 are wound around these eight salient poles 61 thru/or 68 at each **, respectively.

OPERATION

[Function] This invention forms two or more stator shaft-orientations paragnaths at the tip of this salient pole in accordance with shaft orientations at it while it is predetermined spacing and establishes two or more salient poles along with a circumferencial direction in inner skin. It can rotate freely on the cylinder-like stator which has the stator core which formed the stator circumferencial direction paragnath at the tip of these stators shaft-orientations paragnath at the circumferencial direction, and the axis of this stator. Two or more migration child shaft-orientations paragnaths in a pitch are formed. and -- while being arranged movable in accordance with shaft orientations -- the shaft orientations of a peripheral face -- the above-mentioned stator shaft-orientations paragnath -- countering -- etc. -- And since it had the permanent magnet which intervened between [above-mentioned] migration child cores with the migration child who has the migration child core of the pair which formed two or more migration child circumferencial direction paragnaths in the point of these migration child shaft-orientations paragnath along with the circumferencial direction, and was magnetized by shaft orientations By exciting a stator core, a migration child core carries out a step drive at a circumferencial direction while carrying out a step drive at shaft orientations, while a straight-line motion and rotation actuation can carry out by one motor, compared with the conventional motor, it is cheap, and precision improves. Since the laminating of the annular solid in which the migration child circumferencial direction paragnath was formed, and the annular solid which does not form a migration child circumferencial direction paragnath was carried out to the peripheral face and the migration child core was formed while carrying out the laminating and forming the stator core, being able to shift a stator griddle one by one to a circumferencial direction, shaping of a stator core and a migration child core can form an easy and highly precise rotation form linear pulse motor.

from the migration child 5 side. A part with hatching shows addendum section 11a, and a part without hatching shows bottom section 11b.

[0022] It is the thickness of the stator griddle 22 t0 When it carries out, for a gear-tooth pitch, in each salient pole 61 thru/or 68, 2kmt(s)0, 4 [i.e.,], t0 (k= 1, m= 2), and tooth thickness are m-t0, 2 [i.e.,], and t0 by carrying out a rotation laminating. The stator shaft-orientations paragnath 11 is formed. and the time of being based on salient poles 61 and 65 -- a gap of the paragnath 11 of salient poles 62 and 66 -- a gap of the paragnath 11 of salient poles, 1/2km, 1/4 [i.e.,], of a gear-tooth pitch, 63 and 67 -- a gap of the paragnath 11 of salient poles, 2/2km, 2/4 [i.e.,], of a gear-tooth pitch, 64 and 68 -- 3/2km of a gear-tooth pitch -- that is, it comes out 3/4.

[0023] On the other hand, the paragnath 18 in which the die length of the shaft orientations of the permanent magnet 17 arranged by said migration child 5 was arranged by said magnetic pole core 15, and the paragnath 18 arranged by the magnetic pole core 16 are set up so that a gear-tooth pitch may shift 1/2 mutually.

[0024] And the hybrid mold linear pulse motor of two phases can be constituted by connecting the phase by which a coil W1, W3, and the phase around which W5 and W7 are wound are wound around an A phase and coils W2, W4, W6, and W8 so that it may become a B phase. The basic movement magnitude for every step at this time becomes 1/of a gear-tooth pitch (2andm), /4 [i.e., (4 and t0),], and is the thickness t0 of said stator griddle 22. It becomes.

[0025] And according to an input pulse, by carrying out sequential excitation of each phase winding in predetermined sequence, while generating magnetic flux one by one between each stator shaft-orientations paragnath 11 and the migration child shaft-orientations paragnath 18 and making shaft orientations carry out stepping actuation of the migration child 5 at the shape of a step, a circumferencial direction can be rotated in the shape of a step.

[0026] In addition, the technique of this invention is good also by the means of other modes which are not limited to the technique in said example and achieve the same function, and various modification and addition are possible for the technique of this invention within the limits of said configuration.

[Translation done.]

[0017] In output-shaft side bracket 2a of the above-mentioned motor housing 4, and anti-output-shaft side bracket 2b, bearing 12 and 13 is formed, respectively, and, free [migration] moreover, the above-mentioned migration child 5 is supported free [rotation] through these bearing 12 and 13 at the circumferencial direction at shaft orientations. This migration child 5 consists of permanent magnets 17 of the shape of a ring which was pinched a shaft 14, the magnetic pole cores 15 and 16 prepared in this shaft 14, the magnetic pole core 15, and between 16, and was magnetized by shaft orientations. The rolling bearing which moreover supports a shaft 14 movable to shaft orientations at a circumferencial direction is being used for the above-mentioned bearing 12 and 13.

[0018] Two or more migration child shaft-orientations paragnaths 18 (addendum section 18a, bottom section 18b) are arranged in shaft orientations by the peripheral face of the above-mentioned magnetic pole cores 15 and 16. These magnetic pole cores 15 and 16 As shown in <u>drawing 3</u> and <u>drawing 4</u> , the laminating of the small migration child griddle (annular solid) 20 of an outer diameter in which the large migration child griddle (annular solid) 19 of the outer diameter which forms addendum section 18a forms two sheets and bottom section 18b is carried out in the order of two sheets. The migration child circumferencial direction paragnath 21 is formed in the peripheral face of the migration child griddle 19 at intervals of predetermined.

[0019] End section 14a which takes out an output is drawn by the outside of output-shaft side bracket 2a, and other end 14b which does not take out an output is drawn from the above-mentioned migration child's 5 shaft 14 by the outside of anti-output-shaft side bracket 2b.

[0020] <u>Drawing 3</u> shows an example of the stator griddle 22 which forms the stator core 3. Eight salient poles P1 thru/or the inside P3, P4, P7, and P8 of P8 are salient poles (this example four pieces) where an inside diameter is small, and the stator griddle 22 constitutes addendum section 11a of the stator shaft-orientations paragnath 11. Moreover, P1, P2, P5, and P6 are salient poles where an inside diameter is big, and they constitute bottom section 11b of the stator shaft-orientations paragnath 11 (this example four pieces). Corresponding to the above-mentioned migration child circumferencial direction paragnath 21, the stator circumferencial direction paragnath 23 is formed in addendum section 11a of the stator shaft-orientations paragnath 11 at intervals of predetermined along with the circumferencial direction, respectively.

[0021] <u>Drawing 6</u> looks at the situation of the salient pole 61 formed when a laminating is carried out rotating the stator griddle 22 theta= 45 include angles at a time thru/or the stator shaft-orientations paragnath 11 of 68

17 Permanent Magnet
18 Migration Child Shaft-Orientations Paragnath
19 20 Migration child griddle
21 Migration Child Circumferencial Direction Paragnath
22 Stator Griddle
23 Stator Circumferencial Direction Paragnath
11a, 18a Addendum section
11b, 18b Bottom section
W1 — W8 Stator winding

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is partial drawing of longitudinal section showing one example of the rotation form linear pulse motor of this invention.
[Drawing 2] It is a cross-sectional view by the II-II line of drawing 1 .
[Drawing 3] It is the top view of the stator griddle which forms a stator core.
[Drawing 4] It is the top view showing the migration child griddle which prepared the migration child circumferencial direction paragnath.
[Drawing 5] It is the top view showing the migration child griddle which does not prepare a migration child circumferencial direction paragnath.
[Drawing 6] It is the development view which looked at the stator shaft-orientations paragnath section formed when the laminating of the stator griddle of drawing 3 is shifted and carried out to a predetermined include-angle [every] circumferencial direction as it goes to shaft orientations from the migration child side.
[Drawing 7] It is drawing of longitudinal section of the conventional linear pulse motor.
[Drawing 8] It is drawing of longitudinal section of the conventional rotation form linear pulse motor.
[Description of Notations]
1 Stator
3 Stator Core
4 Motor Housing
5 Migration Child
61—68 Salient pole
11 Stator Shaft-Orientations Paragnath
12 13 Bearing
14 Shaft
15 16 Magnetic pole core

* NOTICES *

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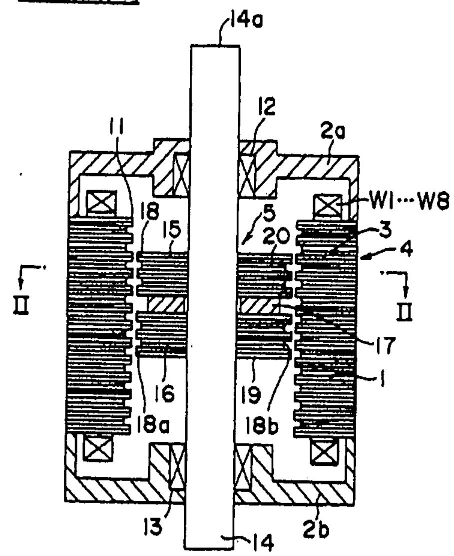
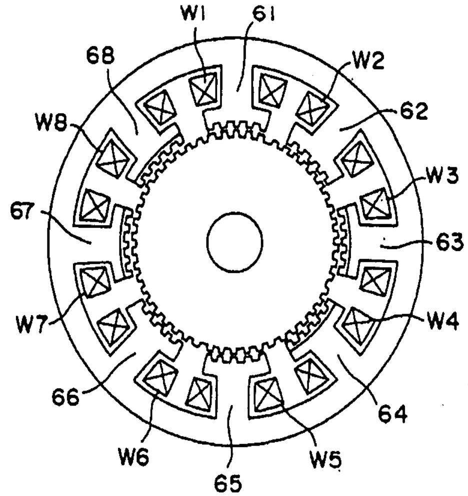
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

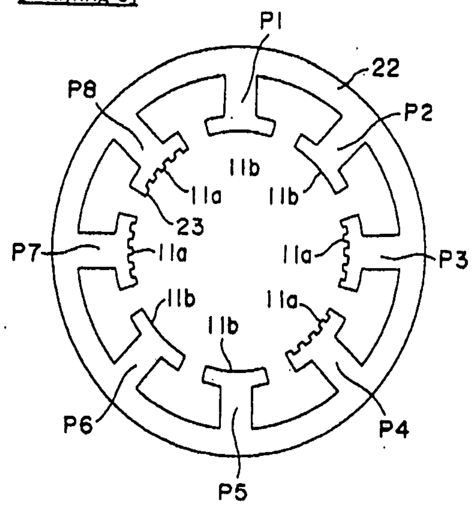
[Drawing 1]



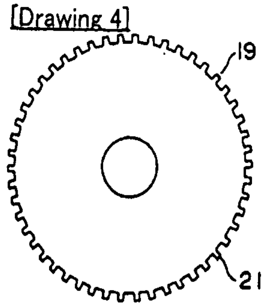
[Drawing 2]

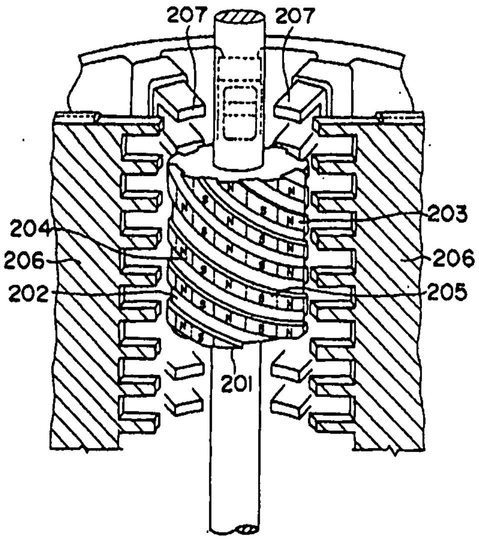


[Drawing 3]



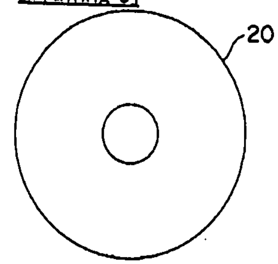
[Drawing 4]



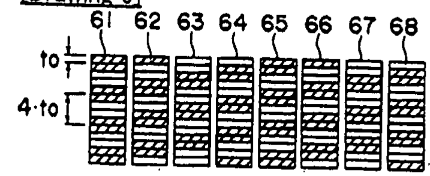


[Translation done.]

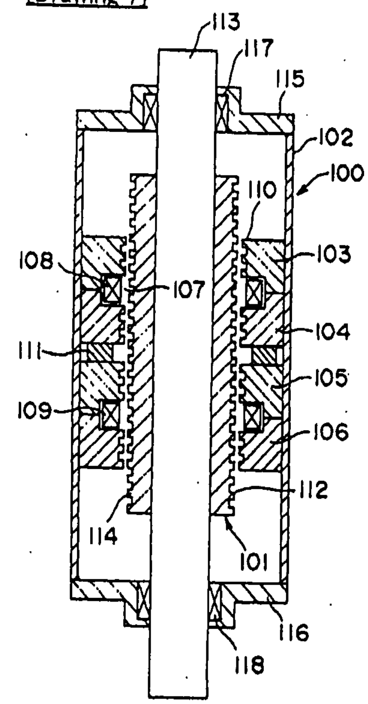
[Drawing 5]



[Drawing 6]



[Drawing 7]



[Drawing 8]

114, the shape of a step is made to carry out stepping actuation of the migration child 101, and, as for said linear pulse motor, basic movement magnitude constitutes one fourth of 2 phase hybrid mold linear pulse motors of the gear-tooth pitch of the migration child paragnath 114.
[Procedure amendment 2]
[Document to be Amended] Specification
[Item(s) to be Amended] 0017
[Method of Amendment] Modification
[Proposed Amendment]
[0017] In output-shaft side bracket 2a of the above-mentioned motor housing 4, and anti-output-shaft side bracket 2b, bearing 12 and 13 is formed, respectively, and, free [migration] moreover, the above-mentioned migration child 5 is supported free [rotation] through these bearing 12 and 13 at the circumferencial direction at shaft orientations. This migration child 5 consists of permanent magnets 17 of the shape of a ring which was pinched a shaft 14, the magnetic pole cores 15 and 16 prepared in this shaft 14, the magnetic pole core 15, and between 16, and was magnetized by shaft orientations. The rolling bearing which supports a shaft 14 pivotable movable moreover to shaft orientations at a circumferencial direction is being used for the above-mentioned bearing 12 and 13.

[Translation done.]

CORRECTION OR AMENDMENT

[Kind of official gazette] Printing of amendment by the convention of 2 of Article 17 of Patent Law
[Section partition] The 4th partition of the 7th section
[Publication date] March 29, Heisei 14 (2002. 3.29)

[Publication No.] JP,8-163857,A
[Date of Publication] June 21, Heisei 8 (1996. 6.21)
[Annual volume number] Open patent official report 8-1639
[Application number] Japanese Patent Application No. 6-303276
[The 7th edition of International Patent Classification]

H02K 41/03

[FI]

H02K 41/03 B

[Procedure revision]
[Filing Date] October 30, Heisei 13 (2001. 10.30)
[Procedure amendment 1]
[Document to be Amended] Specification
[Item(s) to be Amended] 0007
[Method of Amendment] Modification
[Proposed Amendment]
[0007] And according to an input pulse, by energizing in predetermined sequence to said ring-like coils 108 and 109, generate magnetic flux one by one between each stator paragnath 110 and the migration child paragnath

(19)日本国特許庁（ＪＰ）

(12) 公開特許公報（Ａ）

(11)特許出願公開番号
特開平8－163857

(43)公開日 平成８年(1996)６月21日

(51)Int.Cl.⁶ 識別記号 庁内整理番号 ＦＩ 技術表示箇所
Ｈ０２Ｋ 41/03 Ｂ

審査請求 未請求 請求項の数４ ＯＬ （全 ６ 頁）

(21)出願番号 特願平6－303276

(22)出願日 平成６年(1994)12月７日

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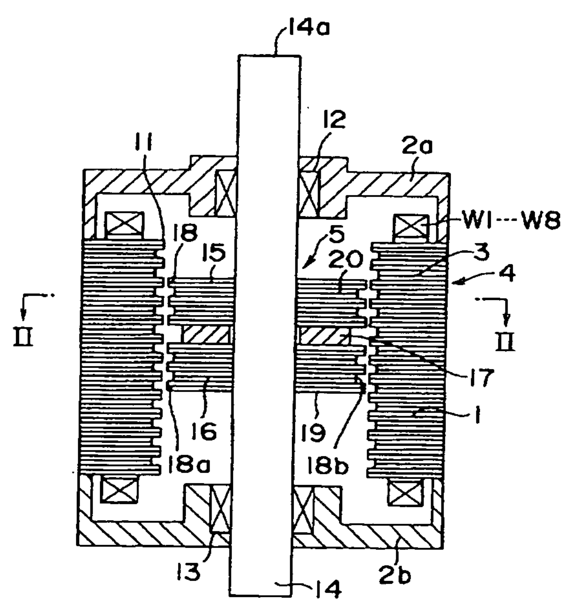
(54)【発明の名称】 回転形リニアパルスモータ

(57)【要約】
【目的】 本発明は、高精度で、安価に製造することができる回転形リニアパルスモータを提供することにある。
【構成】 本発明は、内周面に、円周方向に沿って所定間隔で、複数の突極を設けるとともに該突極の先端に軸方向に沿って複数の固定子軸方向小歯を形成し、これら固定子軸方向小歯の先端に円周方向に固定子円周方向小歯を形成した固定子コア３を有する円筒状の固定子１と、この固定子１の軸線上に、回転自在で、かつ軸方向に沿って移動可能に配置されるとともに、外周面の軸方向に上記固定子軸方向小歯１１に対向して等ピッチで複数の移動子軸方向小歯１８を形成し、かつこれら移動子軸方向小歯１８の先端部に円周方向に沿って複数の移動子円周方向小歯２１を形成した一対の移動子コアを有する移動子５と、上記移動子コア１５，１６相互間に介在され、かつ軸方向に着磁された永久磁石１７とを備えたことにある。



【特許請求の範囲】

【請求項1】 内周面に、円周方向に沿って所定間隔で、複数の突極を設けるとともに該突極の先端に軸方向に沿って複数の固定子軸方向小歯を形成し、これら固定子軸方向小歯の先端に円周方向に固定子円周方向小歯を形成した固定子コアを有する円筒状の固定子と、この固定子の軸線上に、回転自在で、かつ軸方向に沿って移動可能に配置されるとともに、外周面の軸方向に上記固定子軸方向小歯に対向して等ピッチで複数の移動子軸方向小歯を形成し、かつこれら移動子軸方向小歯の先端部に円周方向に沿って複数の移動子円周方向小歯を形成した一対の移動子コアを有する移動子と、上記移動子コア相互間に介在され、かつ軸方向に着磁された永久磁石とを備えたことを特徴とする回転形リニアパルスモータ。

【請求項2】 上記固定子コアは、固定子鉄板を積層して形成されるとともに各固定子鉄板を円周方向に沿って所定角度ずつ順次ずらせながら積層するとともに上記移動子と対向する突極の先端部の構成が移動子側から見たとき、内径の小さい突極と、内径の大きい突極が所定の順に並んで1組を形成し、その組がk組存在することを特徴とする請求項1に記載の回転形リニアパルスモータ。

【請求項3】 上記移動子は外周面に所定間隔を置いて複数の移動子円周方向小歯を形成した移動子鉄板と、移動子円周方向小歯を形成していない移動子鉄板を所定枚数ずつ交互に積層して形成したことを特徴とする請求項1または2に記載の回転形リニアパルスモータ。

【請求項4】 上記移動子の移動子円周方向小歯は歯数が50個または50の整数倍あり、かつ固定子の固定子円周方向小歯は、円周を48または50の整数倍の数で分割されたピッチで形成されていることを特徴とする請求項1ないし3に記載の回転形リニアパルスモータ。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は、直線動作と回転動作を1つのモータで行うことができる回転形リニアパルスモータに関する。

【0002】

【従来の技術】図7は、従来のよく知られている回転形リニアパルスモータを示したもので、固定子100と移動子101とから構成されている。固定子100はフレーム102内に固定子コア103，104，105および106を配置し、固定子コア103，104相互間と固定子コア105，106相互間に形成された凹溝107内にリング状巻線108，109が配置されている。固定子コア103，104はリング状巻線108とともに1つの相を形成し、固定子コア105，106はリング状巻線109とともに他の1つの相を形成している。

【0003】固定子コア103，104，105および106の内周面には軸方向に等ピッチで複数個の固定子小歯110が設けられている。2つの相を形成している固定子コア103，104と固定子コア105，106とは、その間に軸方向に着磁されたリング状永久磁石111を配置しており、全体として2相の固定子100を構成している。

【0004】移動子101は、移動子コア112と軸113とからなり、該移動子コア112の外周面には複数個の移動子小歯114が、固定子小歯110の歯ピッチと同一ピッチで軸方向に等ピッチで設けられている。

【0005】この移動子101はフレーム102両端に設けられたブラケット115，116に軸受117，118を介して支持されている。

【0006】前記固定子小歯110と移動子小歯114とは、以下の位置関係にある。すなわち、固定子コア106に配設された固定子小歯110が移動子小歯114と丁度向き合っているとき、固定子コア105に配設された固定子小歯110は、移動子小歯114に対して（または、固定子コア106に比較して）、歯ピッチの2／4だけ軸方向にずれた位置にあり、移動子小歯114の歯底部に対向している。また、固定子コア104に配設された固定子小歯110は、同様に、歯ピッチの1／4だけ軸方向にずれた位置にある。さらに、固定子コア103に配設された固定子小歯110は、同様に、歯ピッチの3／4だけ軸方向にずれた位置にある。

【0007】そして、入力パルスに応じて、前記リング状巻線108および109に所定の順序で通電することにより、各固定子小歯110と移動子小歯114との間に順次磁束を発生させて、移動子101をステップ状に歩進動作させるようになっており、前記回転形リニアパルスモータは、基本移動量が移動子小歯114の歯ピッチの1／4の2相ハイブリッド型リニアパルスモータを構成している。

【0008】一方、ステッピングモータのロータに、回転しながら直線運動をさせる従来技術として、特開昭63－31462号公報の技術が知られている。この先行技術では、図8に示すように、ロータ201の外周面にスパイラル溝202を形成し、溝間スパイラル凸部203に、交互にN極、S極のマグネット204，205を着磁したものである。そして、円周方向に一定間隔で設けられたステータ206の突極207を軸方向に一定間隔で配置し、このステータ206の突極207を順次励磁して、ロータ201を円周方向に一定間隔でステップ駆動させながら軸方向に一定間隔でステップ駆動させるものである。

【0009】

【発明が解決しようとする課題】しかしながら、前記の先行技術では、ロータ201の外周面にスパイラル溝202を形成し、溝間スパイラル凸部203に多数のマグネット204，205を着磁させるので、製造工程が複雑であるとともに、精度のばらつきが大きく、かつコス

ト面でも割高となっていた。

【００１０】本発明は上記課題を解消し、直線動作と回転動作を１つのモータで行うことができるとともに、高精度で、安価に製造することができる回転形リニアパルスモータを提供することを目的とする。

【００１１】

【課題を解決するための手段】本発明は上記課題を解決するため、内周面に、円周方向に沿って所定間隔で、複数の突極を設けるとともに該突極の先端に軸方向に沿って複数の固定子軸方向小歯を形成し、これら固定子軸方向小歯の先端に円周方向に固定子円周方向小歯を形成した固定子コアを有する円筒状の固定子と、この固定子の軸線上に、回転自在で、かつ軸方向に沿って移動可能に配置されるとともに、外周面の軸方向に上記固定子軸方向小歯に対向して等ピッチで複数の移動子軸方向小歯を形成し、かつこれら移動子軸方向小歯の先端部に円周方向に沿って複数の移動子円周方向小歯を形成した一対の移動子コアを有する移動子と、上記移動子コア相互間に介在され、かつ軸方向に着磁された永久磁石とを備えたことにある。また、本発明は、上記固定子コアは、固定子鉄板を積層して形成されるとともに各固定子鉄板を円周方向に沿って所定角度ずつ順次ずらせながら積層するとともに上記移動子と対向する突極の先端部の構成が移動子側から見たとき、内径の小さい突極と、内径の大きい突極が所定の順に並んで１組を形成し、その組がｋ組存在することにある。さらに、本発明は、上記移動子は周面に所定間隔を置いて複数の移動子円周方向小歯を形成した移動子鉄板と、移動子円周方向小歯を形成していない移動子鉄板を所定枚数ずつ交互に積層して形成したことにある。またさらに、上記移動子の移動子円周方向小歯は歯数が５０個または５０の整数倍あり、かつ固定子の固定子円周方向小歯は、円周を４８または５０の整数倍の数で分割されたピッチで形成されていることにある。

【００１２】

【作用】本発明は、内周面に、円周方向に沿って所定間隔で、複数の突極を設けるとともに該突極の先端に軸方向に沿って複数の固定子軸方向小歯を形成し、これら固定子軸方向小歯の先端に円周方向に固定子円周方向小歯を形成した固定子コアを有する円筒状の固定子と、この固定子の軸線上に、回転自在で、かつ軸方向に沿って移動可能に配置されるとともに、外周面の軸方向に上記固定子軸方向小歯に対向して等ピッチで複数の移動子軸方向小歯を形成し、かつこれら移動子軸方向小歯の先端部に円周方向に沿って複数の移動子円周方向小歯を形成した一対の移動子コアを有する移動子と、上記移動子コア相互間に介在され、かつ軸方向に着磁された永久磁石とを備えたので、固定子コアを励磁することによって、移動子コアは軸方向にステップ駆動するとともに円周方向にステップ駆動し、直線動作と回転動作が１つのモータで行えるとともに、従来のモータに比べて安価で精度が向上する。固定子鉄板を円周方向に順次ずらせながら積層して固定子コアを形成するとともに、外周面に移動子円周方向小歯を形成した環状体と移動子円周方向小歯を形成しない環状体を積層して移動子コアを形成したので、固定子コアおよび移動子コアの成形が容易で高精度の回転形リニアパルスモータを形成することができる。

【００１３】

【実施例】以下、図面を参照しながら本発明の一実施例を詳細に説明する。図１は、本発明の回転形リニアパルスモータの一実施例を示す部分縦断面図、図２は図１のII－II線による横断面図、図３は固定子コアを形成する固定子鉄板の平面図、図４は移動子円周方向小歯を設けた移動子鉄板を示す平面図、図５は移動子円周方向小歯を設けない移動子鉄板を示す平面図、図６は図３の固定子鉄板を積層したときの固定子軸方向小歯部を移動子側から見た展開図である。

【００１４】図１ないし図６において、固定子１は、出力側軸ブラケット２ａと反出力軸側ブラケット２ｂにより図示しないネジ等でネジ止めすることにより支持される。この固定子１は固定子コア３と、固定子コア３の各突極６１ないし６８に巻回された固定子巻線Ｗ１ないしＷ８とで構成されている。上記出力側軸ブラケット２ａと反出力軸側ブラケット２ｂは固定子１の外面とともにモータハウジング４を構成している。出力側軸ブラケット２ａと反出力軸側ブラケット２ｂには後述する移動子５が支持されている。

【００１５】上記固定子コア３は内周面に、中心方向に向けて突出した突極６１ないし６８を円周方向に沿って所定間隔で設けたもので、これら突極６１ないし６８内周面には軸方向に複数個の固定子軸方向小歯１１が等ピッチで設けられている。

【００１６】これら８個の突極６１ないし６８にそれぞれ固定子巻線Ｗ１ないしＷ８が各別に巻回されている。

【００１７】上記モータハウジング４の出力軸側ブラケット２ａと反出力軸側ブラケット２ｂにはそれぞれ軸受１２，１３が設けられ、これら軸受１２，１３を介して上記移動子５が軸方向に移動自在に、しかも円周方向に回転自在に支持されている。この移動子５は軸１４と、この軸１４に設けられた磁極コア１５，１６と、磁極コア１５，１６相互間に挟持され、かつ軸方向に磁化されたリング状の永久磁石１７とで構成されている。上記軸受１２，１３は、軸１４を軸方向に移動可能に、しかも円周方向に支持する転がり軸受けを使用している。

【００１８】上記磁極コア１５，１６の外周面には、軸方向に複数個の移動子軸方向小歯１８（歯先部１８ａ，歯底部１８ｂ）が配設されており、該磁極コア１５，１６は、図３および図４に示すように、歯先部１８ａを形成する外径の大きい移動子鉄板（環状体）１９が２枚、歯底部１８ｂを形成する外径の小さい移動子鉄板（環状

体）２０が２枚の順で、積層されている。移動子鉄板１９の外周面には所定間隔で移動子円周方向小歯２１が設けられている。

【００１９】上記移動子５の軸１４は、出力を取り出す一端部１４ａを出力軸側ブラケット２ａの外側に導き出され、出力を取り出さない他端部１４ｂを反出力軸側ブラケット２ｂの外側に導き出されている。

【００２０】図３は固定子コア３を形成している固定子鉄板２２の一例を示したものである。固定子鉄板２２は、８個の突極Ｐ１ないしＰ８のうちＰ３，Ｐ４，Ｐ７およびＰ８は内径寸法の小さい突極（本実施例では４個）であり、固定子軸方向小歯１１の歯先部１１ａを構成する。また、Ｐ１，Ｐ２，Ｐ５およびＰ６は内径寸法の大きな突極であり、固定子軸方向小歯１１の歯底部１１ｂを構成する（本実施例では４個）。固定子軸方向小歯１１の歯先部１１ａには、上記移動子円周方向小歯２１に対応して、それぞれ円周方向に沿って所定間隔で固定子円周方向小歯２３が形成されている。

【００２１】図６は固定子鉄板２２を角度θ＝４５度ずつ回転しながら積層したときに形成される突極６１ないし６８の固定子軸方向小歯１１の様子を移動子５側から見たものである。ハッチングのある部分が歯先部１１ａを示し、ハッチングのない部分が歯底部１１ｂを示す。

【００２２】固定子鉄板２２の厚さをt_0とすると、回転積層することにより、各突極６１ないし６８には、歯ピッチが$2kmt_0$、すなわち$4 \cdot t_0$（ｋ＝１，ｍ＝２）、歯厚が$m \cdot t_0$、すなわち$2 \cdot t_0$の固定子軸方向小歯１１が形成される。しかも、突極６１および６５を基準としたとき、突極６２および６６の小歯１１のずれは歯ピッチの１／２ｋｍ、すなわち１／４、突極６３および６７の小歯１１のずれは歯ピッチの２／２ｋｍ、すなわち２／４、突極６４および６８の小歯１１のずれは歯ピッチの３／２ｋｍ、すなわち３／４、である。

【００２３】一方、前記移動子５に配設された永久磁石１７の軸方向の長さは、前記磁極コア１５に配設された小歯１８と磁極コア１６に配設された小歯１８とが互いに歯ピッチの１／２ずれるように設定される。

【００２４】そして、巻線Ｗ１，Ｗ３，Ｗ５，Ｗ７が巻回される相をＡ相、巻線Ｗ２，Ｗ４，Ｗ６，Ｗ８が巻回される相をＢ相となるように結線することにより、２相のハイブリッド型リニアパルスモータを構成することができる。このときのステップごとの基本移動量は、歯ピッチの１／（２・ｍ）、すなわち（$4 \cdot t_0$）／４となり前記固定子鉄板２２の厚さt_0となる。

【００２５】そして、入力パルスに応じて、各相巻線を所定の順序で順次励磁していくことにより、各固定子軸方向小歯１１と移動子軸方向小歯１８との間に順次磁束を発生させて移動子５を軸方向にステップ状に歩進動作させるとともに円周方向にステップ状に回転させることができる。

【００２６】なお、本発明の技術は前記実施例における技術に限定されるものではなく、同様な機能を果す他の態様の手段によってもよく、また本発明の技術は前記構成の範囲内において種々の変更，付加が可能である。

【００２７】

【発明の効果】以上の説明から明らかなように、本発明の回転形リニアパルスモータによれば、つぎのような効果を奏する。請求項１において、　内周面に、円周方向に沿って所定間隔で、複数の突極を設けるとともに該突極の先端に軸方向に沿って複数の固定子軸方向小歯を形成し、これら固定子軸方向小歯の先端に円周方向に固定子円周方向小歯を形成した固定子コアを有する円筒状の固定子と、この固定子の軸線上に、回転自在で、かつ軸方向に沿って移動可能に配置されるとともに、外周面の軸方向に上記固定子軸方向小歯に対向して等ピッチで複数の移動子軸方向小歯を形成し、かつこれら移動子軸方向小歯の先端部に円周方向に沿って複数の移動子円周方向小歯を形成した一対の移動子コアを有する移動子と、上記移動子コア相互間に介在され、かつ軸方向に着磁された永久磁石とを備えたので、直線動作と回転動作を１つのモータで行うことができる。請求項２において、上記固定子コアは、固定子鉄板を積層して形成されるとともに各固定子鉄板を円周方向に沿って所定角度ずつ順次ずらせながら積層するとともに上記移動子と対向する突極の先端部の構成が移動子側から見たとき、内径の小さい突極と、内径の大きい突極が所定の順に並んで１組を形成し、その組がｋ組存在するので、固定子の成形を容易に行うことができる。請求項３において、上記移動子は外周面に所定間隔を置いて複数の移動子円周方向小歯を形成した移動子鉄板と、移動子円周方向小歯を形成していない移動子鉄板を所定枚数ずつ交互に積層して形成したので、精度の高い移動子コアの成形を容易に行うことができる。請求項４において、上記移動子の移動子円周方向小歯は歯数が５０個または５０の整数倍あり、かつ固定子の固定子円周方向小歯は、円周を４８または５０の整数倍の数で分割されたピッチで形成されているので、精度の高いステップ駆動を行うことができる。

【図面の簡単な説明】

【図１】本発明の回転形リニアパルスモータの一実施例を示す部分縦断面図である。

【図２】図１のII－II線による横断面図である。

【図３】固定子コアを形成する固定子鉄板の平面図である。

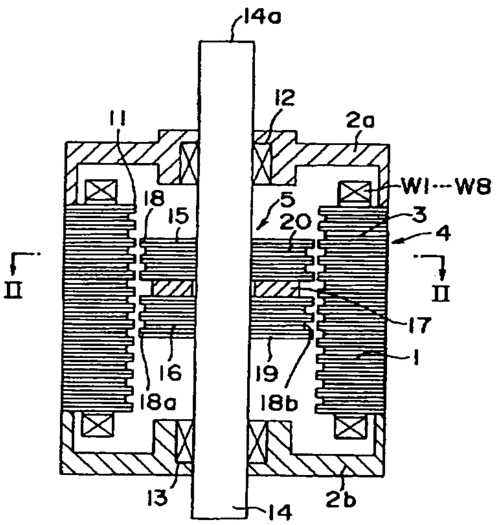
【図４】移動子円周方向小歯を設けた移動子鉄板を示す平面図である。

【図５】移動子円周方向小歯を設けない移動子鉄板を示す平面図である。

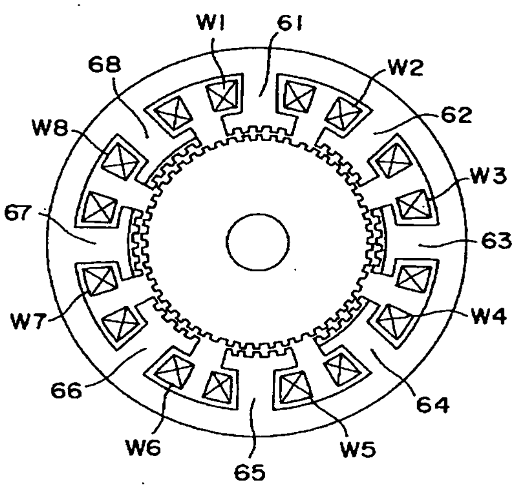
【図６】図３の固定子鉄板を軸方向に行くに従って所定角度ずつ円周方向にずらして積層したときに形成される固定子軸方向小歯部を移動子側から見た展開図である。

【図7】従来のリニアパルスモータの縦断面図である。
【図8】従来の回転形リニアパルスモータの縦断面図である。
【符号の説明】
1　固定子
3　固定子コア
4　モータハウジング
5　移動子
61…68　突極
11　固定子軸方向小歯
12，13　軸受
＊14　軸
15，16　磁極コア
17　永久磁石
18　移動子軸方向小歯
19，20　移動子鉄板
21　移動子円周方向小歯
22　固定子鉄板
23　固定子円周方向小歯
11a，18a　歯先部
11b，18b　歯底部
＊　W1…W8　固定子巻線

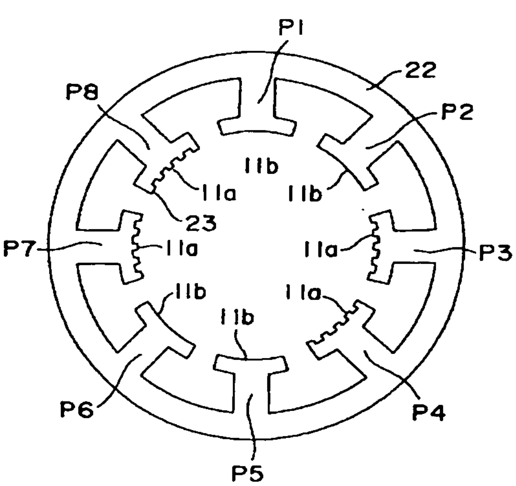
【図1】



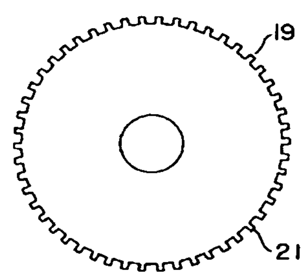
【図2】



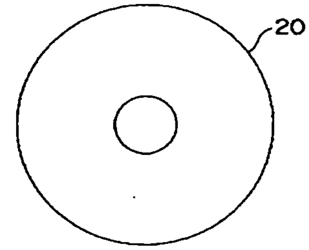
【図3】



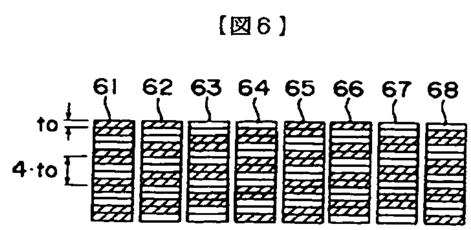
【図4】



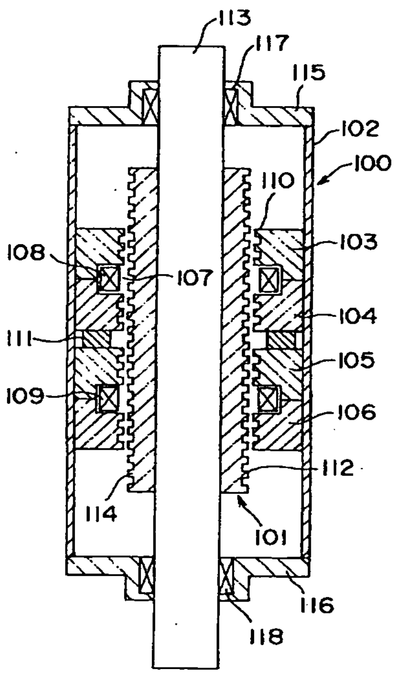
【図5】



【図6】



【図７】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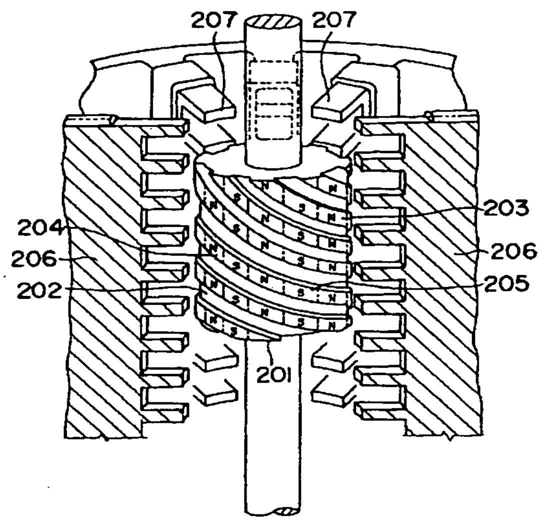
【図８】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【公報種別】特許法第１７条の２の規定による補正の掲載
【部門区分】第７部門第４区分
【発行日】平成１４年3月２９日（２００２．３．２９）

【公開番号】特開平８－１６３８５７
【公開日】平成8年6月２１日（１９９６．６．２１）
【年通号数】公開特許公報８－１６３９
【出願番号】特願平６－３０３２７６
【国際特許分類第７版】
H02K 41/03
【ＦＩ】
H02K 41/03 B

【手続補正書】
【提出日】平成１３年１０月３０日（２００１．１０．３０）
【手続補正１】
【補正対象書類名】明細書
【補正対象項目名】０００７
【補正方法】変更
【補正内容】
【０００７】そして、入力パルスに応じて、前記リング状巻線１０８および１０９に所定の順序で通電することにより、各固定子小歯１１０と移動子小歯１１４との間に順次磁束を発生させて、移動子１０１をステップ状に歩進動作させるようになっており、前記リニアパルスモータは、基本移動量が移動子小歯１１４の歯ピッチの１／４の２相ハイブリッド型リニアパルスモータを構成している。
【手続補正２】
【補正対象書類名】明細書
【補正対象項目名】００１７
【補正方法】変更
【補正内容】
【００１７】上記モータハウジング４の出力軸側ブラケット２ａと反出力軸側ブラケット２ｂにはそれぞれ軸受１２，１３が設けられ、これら軸受１２，１３を介して上記移動子５が軸方向に移動自在に、しかも円周方向に回転自在に支持されている。この移動子５は軸１４と、この軸１４に設けられた磁極コア１５，１６と、磁極コア１５，１６相互間に挟持され、かつ軸方向に磁化されたリング状の永久磁石１７とで構成されている。上記軸受１２，１３は、軸１４を軸方向に移動可能に、しかも円周方向に回転可能に支持する転がり軸受けを使用している。